DOCUMENT RESUME

ED 402 908 IR 018 197

AUTHOR Barker, Bruce O.; Hall, Robert F.
TITLE Long-Term Technology Planning: Laying the Foundation To Improve Illinois Schools.
INSTITUTION Western Illinois Univ., Macomb. Illinois Inst. for Rural Affairs.
PUB DATE Apr 96
NOTE 21p.
PUB TYPE Guides - Non-Classroom Use (055) -- Reports - Evaluative/Feasibility (142)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Computer Literacy; Computer Software; Computer Uses in Education; Educational Finance; *Educational Planning; *Educational Technology; Elementary Secondary Education; Information Skills; Lifelong Learning; *Long Range Planning; Microcomputers; Needs Assessment; School Districts; Staff Development; Technological Advancement; Telecommunications; User Needs (Information)
IDENTIFIERS *Illinois; National Information Infrastructure; *Technology Plans

ABSTRACT

This report provides guidelines for establishing a long-term technology plan for education, applicable to schools in all states. Advanced and emerging telecommunications and computer technologies have resulted in an ever increasing need for teachers and students to develop information processing and lifelong learning skills for gathering and analyzing information. Traditional definitions of literacy will be complemented by the ability to access, exchange, and analyze digital information via telecommunications-based technologies. The report includes the following sections: (1) Introduction; (2) the National Information Infrastructure and its Potential Impact on Schools; (3) The Importance of Developing a Technology Vision; (4) Elements of a Well-Articulated Technology Plan (Statements of Belief Relative to Technology Infusion, Formulate a Vision Statement, Develop Challenge Statements, Identify Strategies for Technology Implementation, and Formulate Objectives and a Definite Action Plan); (5) Suggested Steps in Articulating a Long-Term School/District Technology Plan; (6) Questions To Consider in Assessing Needs/Interest in Selected Technologies; (7) Questions To Consider Regarding Staff Development; (8) Instructional Software or Equipment: What's More Important?; (9) Computer Hardware Specifications; (10) Funding for Technology; (11) Obtaining More Information on Technology Planning for K-12 Schools; and (12) References. (SWC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 402 908

Long-Term Technology Planning: Laying the Foundation To Improve Illinois Schools

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Bruce Barker

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

IR018197

IIRA
Illinois Institute for Rural Affairs

BEST COPY AVAILABLE

Long-Term Technology Planning: Laying the Foundation To Improve Illinois Schools

by Bruce O. Barker and Robert F. Hall

April 1996

Published by Illinois Institute for Rural Affairs
Stipes Hall 518
Western Illinois University
1 University Circle
Macomb, IL 61455-1390

Quoting from these materials for noncommercial purposes is permitted providing proper credit is given to the Illinois Institute for Rural Affairs.

First Printing: April 1996

Printed on recycled paper

Table of Contents

Section	Page
Introduction	1
The National Information Infrastructure and Its Potential Impact on Schools	2
The Importance of Developing a Technology Vision	3
Elements of a Well-Articulated Technology Plan	4
Statements of Belief Relative to Technology Infusion	4
Formulate a Vision Statement	4
Develop Challenge Statements	5
Identify Strategies for Technology Implementation	5
Formulate Objectives and a Definite Action Plan	5
Suggested Steps in Articulating a Long-Term School/District Technology Plan	7
Questions To Consider in Assessing Needs/Interest in Selected Technologies	9
Questions To Consider Regarding Staff Development	11
Instructional Software or Equipment: What's More Important?	12
Computer Hardware Specifications	13
Funding for Technology	14
Obtaining More Information on Technology Planning for K-12 Schools	15
References	16

Long-Term Technology Planning: Laying the Foundation To Improve Illinois Schools

by **Bruce O. Barker and Robert F. Hall**[1]

Introduction

Today's advanced and emerging technologies are having a profound impact on our society. We live in the midst of a "digital revolution" which promises a plethora of electronic wonders. Satellites, cable television, fiber optics, compressed television, interactive multimedia, the Internet and World Wide Web, cyberspace, virtual reality, and sophisticated computer systems are clear evidence that in the past decade instructional and learning resources have expanded far beyond chalkboards and textbooks. As a result, an ever increasing need exists for teachers and students to develop information processing and lifelong learning skills that are directly linked to the use of today's advanced technologies for gathering and analyzing information. Along with the rest of society, education is being transformed by the "communications age," an era brought about by the rapid increase in the amount of data that can be transmitted via telecommunications signals and the increase in information access now available to anyone, anywhere, at any time (Gooler 1994; Thornburg 1994).

Those individuals who master the 21st century's new and emerging information-based technologies are the ones who will have access to a knowledge database beyond comprehension. For the past 200 years, literacy has been chiefly defined as the ability to read, write, and to compute math problems. While this definition of literacy will continue long into the future, it will be complemented by the ability to access, exchange, and analyze digital information via telecommunications-based technologies.

[1]The authors are professor and chair, Department of Instructional Technology and Telecommunications and professor, Department of Educational Administration and Supervision. This report was prepared for the Illinois Center for Rural Education Studies.

The National Information Infrastructure and Its Potential Impact on Schools

A cornerstone of today's "communications age" technologies is the National Information Infrastructure or the NII. The NII is a federal initiative supported by the Clinton/Gore administration that "promises every business, government agency, hospital, home, library, and school in the nation access anywhere to voice, data, full-motion video, and multimedia applications" (U.S. Department of Commerce 1994, p. 57). The federal government describes the NII as a web of communications networks that links computers, databases, and consumer electronics which will ultimately place vast amounts of information resources directly in the hands of users.

The phrase "information superhighway" caught on because of its similarity to a national goal of the 1950s—establishment of the federal interstate highway system. In the same way that the interstate highway system of the Eisenhower years created a network of roads and highways unparalleled in the world, the NII hopes to link information resources to users across the continent through a variety of telecommunications media and networks. But unlike the interstate highway system which was funded chiefly by federal dollars, the information superhighway or NII is being built primarily by the private sector. Much as the interstate highway system enhanced interstate commerce and ease of personal automobile travel by reducing traffic on smaller roads, the information superhighway has two main goals: (1) to increase personal and business opportunities by creating and marketing information services, and (2) to create communications connectivity and broaden bandwidth in order to reduce information traffic congestion on telecommunications networks (Jain 1994). The economic benefit will chiefly be to developers/retailers of multimedia products and to telecommunications providers who "deliver" informational resources to consumers. Users—that is, homes, businesses, schools, and agencies—will be the beneficiaries of vast amounts of information available at their fingertips and available on demand.

One of the biggest challenges facing today's schools is an outdated communications and information infrastructure. Few schools have access to the bandwidth needed to convey vast amounts of information in the form of video, text, and sound. In fact, many schools still have only one or two telephone lines into the building. Few have access to cable television or satellite TV reception and fewer still are connected to data sources via fiber optics. A natural starting point to ensure that schools have affordable access to today's telecommunications technologies is for regional and state-level education policymakers to begin negotiating with cable, telephone, satellite, and other communications providers to discuss issues of cost, connectivity, and bandwidth availability.

School boards and administrators must also recognize that use of the Internet, distance learning, interactive multimedia, and other such technologies have recurring price tags. In the same way that a school has heating and water bills, in the future it will also have "information bills."

The Importance of Developing a Technology Vision

A key point in building a technology infrastructure for schools is long-term technology planning. A long-term technology plan is, in effect, a blueprint for a school's future. School administrators, the school board, and local citizens should work closely to articulate a clear vision of what technology is needed, how it might be obtained, how it is to be used, and how faculty are to be trained. A clear vision will guide decisions about the architecture and planned use of the infrastructure. The vision should establish a basic technology plan which will serve as many goals as possible within the community. Attention should be given not only to student instruction, but also to staff development, adult education, library resources, and so on. Important issues to consider in a technology plan include (1) connectivity—ensuring that as many residents as possible are able to benefit from the information access; (2), interactivity—allowing users to be highly interactive recipients of the information rather than passive observers; (3) supportability—can the technology selected as part of the local infrastructure be supported over the long term; and (4) feasibility—the system must be affordable and reflect practical resources available in the community (Gooler 1995).

Elements of a Well-Articulated Technology Plan

Statement(s) of Belief Relative to Technology Infusion

Vision statements or belief statements express the fundamental convictions/values that undergird a committee's belief in the need for technology within the school or district. They represent firm statements that remain constant whether stated within committee, to the general public, to the faculty, to the staff, or to students. Belief statements are used as a foundation to draft a formal technology mission statement. Examples of *some* belief statements *might* include the following:

- Technology is a means, not an end.
- Learning is a lifelong process.
- The classroom teacher remains the primary facilitator of learning, but the role of teaching will change with the infusion of technology in the classroom. The teacher will serve more as a guide directing students to learning activities rather than conveying facts and information.
- Technology will benefit students in the following ways:

  They will have greater control over their own learning.

  They will be able to adjust to the changing needs of society.

  They will be able to access, exchange, and analyze information readily from electronic data sources.

- Technology supports learning

  by serving as a tool for teaching and learning.

  by accommodating different learning styles.

  by providing immediate access to global information.

Formulate a Vision Statement(s)

This is a clear statement(s) of where the technology should take the school/district relative to the integration of technology in the instructional process.

An example might be as follows:

- All students in the school/district will be able to access and use effectively any information needed to function as a productive member of 21st century society.
- Teachers will be able to use state-of-the-art technologies for preparing their lessons and for teaching their students.

Develop Challenge Statements

Challenge statements put forth issues that must be addressed if the technology plan is to accomplish the desired outcome identified in the vision statement.

Sample challenge statements might include the following:

- Increase technical infrastructure in the school/district.
- Provide additional hardware/software in the school/district.
- Gather data on research, assessing efficacy of new technologies.
- Gain community support for expensive technologies in the school/district.
- Provide staff development for all faculty/staff.
- Obtain funding to finance new technologies.

Identify Strategies for Technology Implementation

Strategies identify the pertinent actions or methods to address and overcome the challenges noted in the preceding challenge statements. Strategies must be action oriented. Some examples might include

- providing each teacher with a personal computer.
- providing each student with desktop access to interactive information technology.
- connecting Internet access in each classroom.
- training administrators, teachers, and staff to properly work with new technologies.
- obtaining grant funds to help pay for new technologies and software.
- gaining community support to pass a referendum.

Formulate Objectives and a Definite Action Agenda

Objectives are clear statements of specific actions which must be taken to put the previously identified strategies into effect. A properly written action agenda includes the following:

1. a clear statement of objectives
2. specific action needed to accomplish the objectives
3. identification of who is responsible to accomplish the objectives
4. a realistic timeline for completion of the objectives
5. anticipated costs of achieving the objectives
6. a method of evaluating the accomplishment of the stated objectives

The statement of objectives and the action agenda might follow a format as outlined below:

Objectives	*Action*	*Who*	*Timeline*	*New Costs*
Provide appropriate technical infrastructure.	Conduct classroom needs assessment on technical infrastructure. Develop a plan and cost estimate for providing the technical infrastructure.	Media Director, with consultants	Oct.-Nov. 1997	$1,000
Train teachers, administrators, and staff to use distance learning.	Provide workshops on regular basis. Hire trainers from local state university.	Media Director Principal	Ongoing Nov. 1997	No cost $600

Suggested Steps in Articulating a Long-Term School/District Technology Plan

The suggestions noted below are intended to start the process of long-term technology planning:

1. *Select and train a technology planning committee.* Membership on the committee might include a mix of elementary, middle school, and high school teachers; building administrators; the media center director; representation from the school board; selected community members; selected parents; and student leaders. Membership should not exceed 12-15 people. Ideally, should include broad representation, be large enough to present a range of ideas, and yet small enough to get things done.

2. *Orient the technology planning committee.* Clarify roles and responsibilities of committee members, issue a clear "charge" of the tasks they are to accomplish, set a reasonable deadline for task completion, provide necessary information on emerging technologies, and implications of technology infusion in society and in schools, and so on.

3. *Develop a written technology plan.* Have the committee formulate objectives and a definite action agenda as noted on page 6 of this report. In addition to stating objectives and outlining an action agenda, the technology plan should also accomplish the following:

   - assess current resources (hardware, software, facilities)
   - identify current infrastructure for technology infusion in the school/district
   - determine additional infrastructure requirements (trained consultants such as telephone technicians, and electricians, may be needed to assist in infrastructure planning)
   - identify curriculum goals and desired outcomes for students relative to technology infusion
   - determine instructional technology needs for classroom teachers
   - determine instructional software/courseware requirements remembering that the quality and value of the software/courseware should drive decisions on hardware acquisition
   - identify specific technologies and determine how their acquisition/use will benefit students and teachers—for example distance learning (satellite, cable TV, video conferencing, video telephones, and so on), interactive multimedia, use of the Internet and World Wide Web, instructional video, and telecommunications
   - identify new strategies/methods teachers might use to best optimize use of new technologies (e.g., cooperative learning, electronic field trips, local videotape production, group problem solving, and so on)
   - identify plans for staff development focused on technologies and proper strategies resulting in systemic change for infusing technology into the instructional program
   - identify strategies for gaining community support
   - determine budget requirements
   - formulate a plan for equipment/software/courseware acquisition and for infrastructure upgrading which is feasible, affordable, and sustainable

- make plans for keeping the long-term technology plan current (how often will it be updated? reviewed?)
- provide for an ongoing assessment and evaluation of the plan
- plan for equipment security, use, maintenance, upgrading, and replacement
- make the plan easy to read and share it with policymakers (e.g., logical table of contents, clear explanation of content in an easy to understand format, glossary of any "difficult" terms, graphs/tables/charts which enhance the understanding of the plan, acknowledgments and references of sources, and so on)
- find out where technology plans from other districts/schools can be obtained; no need to "reinvent the wheel" if a good working model from elsewhere can be adapted for local needs
- determine budget needs for your plan on a one year, or two year, basis, for example

Questions To Consider in Assessing Needs/Interest in Selected Technologies

Responses to the following questions will assist educators in articulating a formal long-term technology implementation plan (adapted from Thornburg 1994):

- What is the current status of CATV (cable television) to each of your classrooms? What plans do you have to expand this service if needed?
- What type of satellite television services do you have on your campus? What plans do you have to increase your access to satellite communication?
- What is the current status of outside phone lines to each of your classrooms? What plans do you have to expand this service if needed? Rather than bring phone lines to each classroom, do you plan to add a "telephone server" as part of a local area network (LAN), or do you plan to install a multiline PBX system with access to each classroom?
- What is the current status of your campuswide LAN? Is it connected to other services (e.g., an Internet host)? Do you have high-speed network connections to each classroom? What plans do you have to add capacity if needed?
- What is the current status of Integrated Services Digital Network (ISDN) lines on your campus? Is your local telephone company offering special ISDN services for educational institutions? Do these services afford you new educational opportunities that justify bringing these services to your classrooms?
- Does your campus have its own Internet host? Do you intend to secure a high-speed connection to the Internet, or to a local university of college (or other organization) where such a service might be provided?
- What dial-up connections are available for students to use at home when they want to connect to the school network, or to gain access to the Internet?
- Do you subscribe to the following magazines: *Macworld*, *Electronic Learning*, *Technology and Learning*, *MacWeek*, *Internet World*? Do you know where you can get these professional magazines to keep abreast of instructional technologies impacting education?
- Do you have access to X•Press X•Change in your classrooms? This service provides numerous real-time wire feeds from newswires all over the planet (AP, Tass, National Weather Service, CNN, and so on) and is often offered free to schools by your local cable provider. X•Press X•Change uses a special modem to connect your television cable to a computer for the newswire feeds. The received information is then saved on your disk. For information on this service, call 1-800-7PC-NEWS.
- Do you have access to one or more commercial services such as America Online, Prodigy, Genie, or Compuserve? Have teachers been made aware of any special discounts for these services that might be available to them (e.g., America Online provides significant discounts to NEA members)?
- Does your site have its own high-speed Internet node? Have you explored the possibility of securing a dedicated broadband connection to the Internet (probably located in a library or other place of easy general access)?

- Do you currently subscribe to the *Nautilus CD-ROM*? This monthly publication, available for both the Macintosh and Windows platforms, provides a rich array of materials relating to education, industry news, desktop media, entertainment, software tools, and public-domain software and shareware (1-800-637-3472).
- Do you subscribe to *CD-ROM Professional*, *New Media*, *Morph's Outpost*, and other journals devoted to keeping you updated on new software being published on CD-ROM's?
- Do you have the latest *Library of the Future CD-ROM* containing about a thousand classical works of literature, or do you have other literary compilations available on CD-ROM?

Questions To Consider Regarding Staff Development

Responses to the following questions will assist educators in addressing the issue of staff development as part of a school's/district's technology implementation plan (adapted from Thornburg 1994):

- Do you have a professional library for staff members with current subscriptions to educational journals, technology magazines, and other periodicals of interest to educators?
- Do you maintain a library of current books on educational practice, future societal trends, strategies for implementing change, and other topics of interest to educators?
- Do you support "book reports" or "salons" in which educators spend time discussing books or articles they have read and applying what they have learned to their practice in the classroom?
- Does every educator have free access to online services from home, as well as from the site, that they can use to keep abreast of the latest issues confronting education?
- Does every educator know how to subscribe to the various newsgroups pertaining to education through which they can share ideas and ask questions?
- What technology do you have in place to allow educators to take part in statewide educational summits, "town hall" meetings, and the like through the use of satellite downlinks, Internet and so on?
- How many educational (curricular and/or pedagogical) conferences per year does each educator attend through the sponsorship of the school?
- How many regional and/or national educational technology conferences per year does each educator attend through the sponsorship of the school?
- What budget for educational materials is each educator given to spend on educational materials discovered at the various conferences he or she attends?
- How many days of staff development in pedagogy, curriculum, and technology is each educator provided each year with school sponsorship?
- How many days of follow-up to site-based staff development are provided for each day of workshop participation?
- What plans are in place to alert educators to relevant courses offered at local colleges and universities to help them develop and maintain skills?
- What distance learning services are offered at the site for staff development (e.g., TI-IN, Mind Extension University, WIU/ISBE Satellite Education Network, and so on)?

Instructional Software or Equipment: What's More Important?

A sound technology plan is based on the idea that curriculum and pedagogy drive software selection, and that software availability and quality drive hardware acquisition (Thornburg 1994). Today, the two common platforms for educational computing are the Macintosh and IBM-compatible machines. The recent entry of Macintosh PowerPC-based computers offers, for the first time, true cross-platform compatibility along with the capacity to run new programs with pronounced improvement in speed and performance over versions designed for either of the native (Macintosh or PC) platforms.

Technology purchases need to be driven by software, and for education (especially in the K-12 world) the bulk of equipment purchases for the classroom will be split between the Apple Macintosh (or PowerPC) platform and IBM or IBM-compatible machines.

Computer prices are dropping while performance improves, and any purchase made today will be out of date in a matter of months. It is also the case, however, that every day's delay in securing the hardware and software needed for education steals precious time from the educators and students who will benefit from these tools. Accordingly, technology purchases should be made with the anticipation of a useful equipment life of approximately five years.

Computer Hardware Specifications

Every desk-based computer system should have at least the following minimum specifications (adapted from Thornburg 1994):

- Color monitor with 256 colors at a resolution of 640x480 pixels
- Built-in hard disk with at least 200 MB capacity (Macintosh) or larger (for Windows) for application and system software storage
- Built-in CD-ROM drive
- Built-in local area network support (based on the capabilities of your LAN)
- High-speed modem (28.8 kb/sec minimum) if online services are provided through ordinary phone lines
- Large capacity removable media storage device for multimedia projects—Computer images and sound files are typically quite large. While these files can be efficiently compressed once the project is completed, they should be left in their uncompressed state during editing. It is common for a work in progress to require a very large amount of disk space during creation, yet end up on a single high-density floppy disk when completed. This external storage system could be a high-speed drive based on the Syquest or Bernoulli technologies
- Sound capture capability of at least 22 kHz at 8-bits with the option of expansion to 44 kHz at 16-bits (CD quality audio) if needed
- Analog video capture capability allowing images from student-generated video tapes to be captured as either still images or movies; still image capture should support full-screen 8-bit (256 colors) or higher resolution

Additional peripheral hardware includes the following:

- High-resolution color projection system to show computer images on a screen—This can consist of either a video projector or a liquid crystal color display plate used in conjunction with a high-brightness (3,000 lumens or more) overhead projector
- High-resolution color scanner for flat art (600 dpi or more) for digitizing color photographs or other images that might be already available on paper
- Digital still camera for capturing color still images that can be transferred directly to the computer for digital image manipulation (e.g., Apple QuickTake 100 or similar software)
- Video camcorder
- NTSC scan converter to allow computer images to be mixed with video images and/or recorded on videotape (e.g., the TelevEyes device from Digital Vision)
- Sound system for stereo playback of multimedia sounds
- Laser videodisc player with computer interface (e.g., Pioneer 2400)
- Telecommunications software with a graphical user interface for accessing Internet information on the World Wide Web (e.g., Mosaic, Netscape, Java)

Funding for Technology

The creation of a budget for your technology plan is essential, even if you do not have a ready source of funding identified. First, your funding section makes the plan real. Without it, the plan is just a brainstorming exercise. Second, if you already know how much you need to fund the plan, you will be able to take immediate advantage of grant opportunities as they are announced. Also, it would be wise to create your funding plan on an electronic spreadsheet so that as you make changes and additions, you can see the results immediately.

In developing a technology plan, funding should include both capital expenses and recurring costs. Given the rapid pace of technological development, it is probably most realistic to view all expenditures as recurring costs with different timelines. Some costs are incurred every year (e.g., telecommunications services, consumables, staff development, software, and upgrades), while others may be renewed every five years or so (computers and other "capital" items).

In working out the funding portion of your plan, the following ideas might prove useful (adapted from Thornburg 1994):

- Budget 30 percent or more of all technology expenditures for staff development. Any less and you risk seeing the technology not used at all, or worse yet, used to replicate an outdated curriculum.
- Spend year-end money on software instead of hardware. New computers are often introduced during the summer break resulting in the arrival of outdated overpriced equipment in the Fall based on purchase orders cut during the previous school year. In the event that software is upgraded over the summer, most software vendors will provide free or very low-cost upgrade options in the Fall.
- Budget for ongoing consumable and maintenance expenditures.
- Think about your staffing needs. For example, if you are setting up a local bulletin board system (BBS) for your school, who is going to maintain it? Don't count on volunteer enthusiasm forever. If appropriate, qualified students might take over much of the responsibility as part of a class project.

Obtaining More Information on Technology Planning for K-12 Schools

The *K-12 Networking Technology Planning Guide for Illinois*, which was produced by the Illinois State Board of Education in late 1995 and released to K-12 schools throughout the state in early 1996, contains useful information to help connect Illinois schools with 21st century information technologies.

Another valuable resource for gathering detailed information on technology planning, including a database of exemplary school technology plans and planning aids, can be obtained from the National Center for Technology Planning (NCTP), P.O. Box 5425, Mississippi State University, MS 39672; telephone: (601) 325-2281 (Plans Online 1995). The contact person at the NCTP is Larry S. Anderson (e-mail: lsal@Ra.MsState.edu).

Still other online resources include the following World Wide Web sites available on the Internet:

- The "home page" for the North Central Regional Educational Laboratory (NCREL) which can be accessed at URL

  http://www.cic.net/ncrel/tandl/about.htm

  This site provides links to technology plans, planning tips, and other useful data for administrators and teachers who seek information on infusing technology into teaching.

- The "home page" for the International Society for Technology in Education which can be accessed at URL

  http://isteonline.uoregon.edu/

  Similar to the NCREL home page, this site offers valuable links to a number of other technology-focused resources on the Web.

- The Yahoo education index site which can be accessed at

  http://www.yahoo.com/Education/K_12/School_districts/

  Stanford University's Yahoo site is one of the most popular sites on the Web. The educational index provides a broad range of data, including lesson plans, in-depth technology models, detailed planning information, and so on.

- The Apple Computer K-12 "home page" which can be accessed at

  http://www.info.apple.com/education

  This site provides detailed information on the Apple Classroom of Tomorrow's research program, which is based on a ten-year study of the effect of technology in classrooms and in staff development.

In addition to these sites, interested readers are encouraged to conduct their own online "searches" via the Internet in order to identify other sites with current information on the ever-evolving role which technology is having on teaching and learning.

References

Gooler, D. D. 1995. "Technology for Rural Schools and Rural Communities in the Twenty-First Century: Building an Infrastructure and a Vision." Paper presented at the North Central Regional Educational Laboratory Rural Education Advisory Council meeting, Oak Brook, IL, March 3-5.

Gooler, D. D. 1994. *Toward a Technology Infrastructure for Education: Policy Perspective I* (Policy Brief, Report 3). Oak Brook, IL: North Central Regional Educational Laboratory.

Jain, V. K. 1994. "The Multimedia Magic Carpet," *The World and I: A Chronicle of Our Changing Times* (November): 24-31. Published by the Washington Times Corporation.

Plans Online. 1995. *Electronic Learning,* 14(7)(April): 39.

Thornburg, D. D. 1994. "Transforming Education in the Communication Age: Goals 2000 and the National Information Infrastructure." Keynote address presented at the Illinois Education and Technology Conference, Peoria, Illinois, October 6-7. Complete text available from Thornburg Center, P.O. Box 7168, San Carlos, CA (or) from David Thornburg, e-mail: DThornburg@aol.com

U.S. Department of Commerce. 1994. *Putting the Information Infrastructure To Work: Report of the Information Infrastructure Task Force Committee on Applications and Technology.* Washington, DC: U.S. Government Printing Office.